Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
Amendment of the Commission's	)	GEN. Docket No. 90-314 Rules to
Establish New Personal	)	ET Docket No. 92-100
Communications Services	)	

REPLY COMMENTS OF INTERDIGITAL COMMUNICATIONS CORP.

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SUMMARY

InterDigital Communications, Inc., a leader in the development of Time Division Multiple Access ("TDMA") and Code Division Multiple Access ("CDMA") wireless technologies, strongly believes that the Commission must allocate more than 30 MHz of spectrum to personal communications services ("PCS") licenses. An allocation of 40 MHz (and preferably 60 MHz) is required to avoid interference between PCS licensees and incumbent 2 GHz users, avoid delays in initiation of PCS service, and increased user costs. A minimum 40 MHz allocation will also facilitate sharing with incumbent users and permit a broad array of PCS applications to develop in the future.

InterDigital also cautions the Commission to ensure that PCS' potential to compete with cellular services does not result in undue limitations of PCS. In particular, rather than adopt a limited 20 MHz allocation, the Commission should allocate the spectrum necessary for PCS to achieve its full potential, i.e., a minimum of 40 MHz for each PCS licensee, and, if appropriate, make available additional spectrum for PCS use by cellular providers.

In light of the scarcity of spectrum in the United States and Commission's proposed migration plan, InterDigital recommends that the Commission encourage PCS licensees to employ existing efficient sharing techniques including overlapping spectrum plans and notch filters. PCS licensees who employ such spectrum-saving techniques should be rewarded by gaining access to additional spectrum.

InterDigital also supports a PCS licensing scheme that would avoid delay and encourage broad participation by multiple entities -- large and small -- and ensure that sufficient capital will be available to support widespread bandclearing of fixed users. To that end, InterDigital's proposes an open-entry license scheme based on three nationwide consortia of PCS providers. Finally, given the complex technical nature of competing proposals for PCS systems and rapid developments in the PCS area, InterDigital urges the Commission to consult fully with the academic and research community involved in PCS to assess the relative merits of PCS proposals. The public interest requires that the Commission should not overlook this important source of objective theoretical and practical knowledge regarding PCS technologies.

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INTRODUCTION

InterDigital Communications Corporation ("InterDigital") submits these reply comments in the above-captioned proceeding. InterDigital is a wireless technology manufacturer that pioneered the use of radio in the telephone local loop. Its Ultraphone system, which is based on Time Division Multiple Access ("TDMA") technology, is the industry standard for radio-based local loop connections.

In addition to TDMA technology, InterDigital is a leader in the development of Code Division Multiple Access ("CDMA") technology. Through its recent acquisition of SCS Mobilecom, Inc. -- an early pioneer in the development of CDMA technology for the personal communications service ("PCS") market -- InterDigital merged the CDMA technology developments of SCS with its mature TDMA technology. This broad-based technology foundation places InterDigital in the forefront of wireless technology companies positioned to provide a wide array of technology solutions for the wireless industry. Based on this extensive expertise and its review of the initial comments in this proceeding, InterDigital urges the Commission to, among other things, allocate at least

40 MHz (and preferably 60 MHz) for PCS operations, and adopt a flexible, inclusive licensing scheme based on three nationwide consortia of PCS providers.

DISCUSSION

In the initial comments in this proceeding, InterDigital stressed three major points: (1) the need to allocate sufficient spectrum for licensed PCS; (2) the need to make PCS licensee eligibility all-inclusive, and (3) the need to design a licensing plan which provides access to licensing for all entities who wish to provide PCS to the public. Our reply comments will expand on these important points.

I. 30 MHz of Spectrum for PCS Licenses is Insufficient to Accommodate PCS Services

A. The Potential For Interference With Incumbent Users Requires a 40 MHz Allocation

The Commission's proposal in the Notice to allocate 30 MHz of spectrum to three PCS licensees is inadequate to support PCS. For the reasons discussed below and in InterDigital's initial comments, InterDigital supports and allocation of at least 40 MHz (and preferably 60 MHz of spectrum) for PCS use.[1/] One of the major conclusions of the FCC's report on PCS costs recently released by the Commission's Office of Plans and

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[1/] In Section 2.C below, InterDigital specifically recommends that the Commission establish 40 MHz PCS operations by authorizing three licensees to provide 60 MHz operations with a 50% overlap using efficient sharing and interference avoidance techniques.

Policy ("OPP"),[2] is that there are major markets throughout the United States in which licensees using only 30 MHz would be unable to develop a viable PCS. In that report, OPP outlined the compelling reasons to allocate spectrum blocks larger than 30 MHz. The report states that "...increased interference requirements due to incumbent microwave users could be a reason for a larger spectrum allocation size, particularly in regions of dense microwave use."[3] InterDigital concurs with the report's conclusion that, because of the variance in microwave densities, PCS suppliers should be permitted to consolidate licenses up to 40 MHz.

B. A 30 MHz PCS License Allocation Will Delay Service and Increase User Costs

The Commission's report also underscores the inadequacy of a 30 MHz allocation by pointing out a problem unique to the 2 GHz band. Because the microwave users in the 2 GHz band occupy 10 MHz channels, a microwave user would normally overlap two separate 30 MHz PCS licensees. In this case, the report said "...one licensee could attempt to gain a "free ride" at the expense of another licensee trying to move the microwave incumbent."[4]

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[2] See The Cost Structure of Personal Communications Service, Office of Plans and Policy (OPP Working Paper No. 28), Federal Communications Commission, November 1992. The primary thrust of this report was an economic rationale for a minimum allocation of 20 MHz. The case against a 30 MHz allocation and for a 40 MHz allocation, however, are equally compelling.

[3] Id. at p. 54.

[4] Id.

The difficulties inherent in this situation are magnified where three 30 MHz licensees with different construction schedules and the need to provide service in different locations are required to negotiate a fair sharing of costs to relocate a specific microwave link. Each negotiation would involve an elaborate, three way process of identifying the individual benefit and determining a fair-cost sharing formula. This process would not only inject significant delays in initiating service, but also it would impose substantial transactional costs. The costs of these negotiations would, of course, be added to the microwave relocation costs and subsequently passed directly to end users.

C. A 40 MHz PCS Allocation Will Facilitate Sharing

The 10 MHz channelization of the incumbent microwave users in the 2 GHz band will also have a direct impact on shared use. As proposed by the Commission, some microwave users will not be relocated during the transition period, or, in some cases even after the transition period.[9] In some cases, therefore, PCS providers will be limited to the unoccupied portions of the spectrum. Associated PCN Company in its initial comments recognized the resulting need to share: "[t]he Commission is proposing a lengthy transition period for relocation of private users in the 2 GHz band and no relocation for

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[9] Existing 2 GHz users will be subject to voluntary negotiated relocation during the transition period. Public safety 2 GHz users, however, will not be required to relocate to other frequency bands.

public safety users. Thus, there will be a continuing need for shared use and therefore more spectrum will be needed by PCS licensees than if the spectrum were clean."[6]

Similarly, Motorola in support of a 40 MHz allocation stated: "[i]n our view, this [40 MHz allocation] maximizes, within the constraints of the spectrum available, the potential to initiate service on a shared basis with incumbent microwave users."[7] MCI and Comsearch concur: "[i]t is apparent that a block allocation of less than 40 MHz per licensee could severely restrict the ability of any company to offer PCS service in some cities."[8] InterDigital agrees with these parties that an allocation greater than 30 MHz, i.e., a 40 MHz allocation, is necessary to permit sharing in the 2 GHz band.

D. PCS Licensees Will Require 40 MHz to Permit Full Development of PCS Applications

Another important rationale supporting a 40 MHz allocation block is the current uncertainty surrounding the application of PCS. The Commission must be careful to establish a PCS scheme that is highly flexible, capable of accommodating -- and encouraging -- the future development of heretofore unexplored PCS applications. In that regard, the Commission's PCS cost report concludes that an allocation of less than 40 MHz of spectrum "...might not be enough spectrum to deliver wireless applications that have not been considered in this analysis." Consistent with InterDigital's view, the report

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[6] Comments of Associated PCN Company, at 3.

[7] Comments of Motorola, Inc., at 11.

[8] Comments of MCI Telecommunications Corporation, at 5 in reference to a Comsearch report appended to the comments.

points out that "...there could be other applications, perhaps not even conceived of at this point in time, with characteristics that require wider channels and a larger spectrum block..."[9]

In particular, adopting an allocation of less than 40 MHz also would needlessly restrict the development of wideband CDMA systems for PCS. In its initial comments, InterDigital described the significant advantages of wider bandwidth CDMA -- increased capacity, improved performance, excellent voice quality, higher data throughput, and better fade margin. These significant advantages of wideband CDMA, relative to narrowband CDMA technologies, are essential to ensuring the success of PCS in the United States. The Commission would effectively foreclose any possibility of bringing the benefits of wideband CDMA to American users if it adopts an allocation scheme that "forces" CDMA systems into a narrow bandwidth that will require CDMA providers to "work around" existing microwave users.

Most CDMA developers are currently anticipating using as much bandwidth as possible to take full advantage of CDMA's benefits. Several companies, including InterDigital, would be forced to abandon plans for a 20 MHz or wider spread spectrum system because they would be unable to avoid overlap with 10 MHz microwave users if forced to operate under a 15 MHz channel scheme dictated by a 30 MHz allocation. A 40 MHz allocation, on the other hand, would provide the necessary leeway to PCS

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[9] Id.

providers to design optimum systems which minimize the overlap and thus operate interference free.

II. The FCC Should Encourage and Not Prohibit PCS Licenses to Employ The Currently Available Efficient Sharing Techniques

Many would agree that the scarcity of spectrum in the United States is by far the greatest obstacle to rapid introduction of PCS and other emerging technology services. The Commission should, therefore, encourage spectrum users to employ spectrum sharing or spectrum-saving techniques where appropriate. InterDigital has demonstrated through extensive analysis and experiments, that efficient sharing techniques currently exist.

A. Sharing Can Be Accomplished by Overlapping Spectra

InterDigital (acting as former SCS Mobilecom, Inc. SCS) proved that efficient sharing of the spectrum could occur when each licensee employed direct sequence spread spectrum.[10] In that case, the spectrum allocated to each licensee could overlap by as much as 50% without significantly limiting performance. For example, if the FCC allocated a non-overlapping 15 MHz transmit and a 15 MHz receive bandwidth to each

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[10] See "Spectrum Allocation to Accommodate Two or More Competitive Systems", (D.L. Schilling and R.L. Pickholtz), SUPERCOMM ICC'92, June 14-18, 1992, Chicago, IL; "Broadband-CDMA: A PCS Wireless Technology to Achieve Wireline Quality and Maximize Spectral Efficiency", (D.L. Schilling), EMC ZURICH'93, March 9-11, 1993, Zurich.

licensee, four licensees would use a total of 60 MHz of transmit and a 60 MHz receive spectrum. Allowing a 50% spectral overlap, the four licensees could have a transmit (and a receive) bandwidth of 24 MHz. This represents a 60% increase in transmit (and receive) bandwidth, which results in a significant increase in the ability of the PCS user to provide improved services.

B. Notch Filters Should Be Employed To Facilitate Sharing

InterDigital (as SCS) also previously demonstrated that the use of a single notch filter located in the PCS mobile unit will permit a very high density of PCS users to operate in regions where microwave users operate.[11] However, in order to notch out the transmitted energy from a 10 MHz band which is occupied by a microwave user a bandwidth of at least 30 MHz is required. Three PCS licensees can share a 60 MHz transmit spectrum and each have a 30 MHz transmit bandwidth when a 50% spectral overlap is employed.

InterDigital therefore recommends that the Commission consider issuing three PCS licenses, each having a transmit bandwidth of 30 MHz and a receive bandwidth of 30 MHz, with a 50% overlap. Dynamic Capacity Allocation[12] ("DCA") should be employed to automatically regulate system capacity and guarantee fixed microwave users that

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[11] See "PCN America Report to FCC", Results of Field Trials Held in Houston, Texas and Orlando, Florida, April 8 through May 9, 1991, FCC File No. 1343-EX-PL-90 (Experimental License), Dated May 6, 1990.

[12] See InterDigital Comments, at 7-8.

microwave performance will not be degraded. This interference avoidance technique will permit coexistence with microwave users with an extremely high degree of confidence that harmful interference will not occur. Use of DCA techniques will therefore allow a smooth transition of existing 2 GHz users and simplifying migration negotiations between PCS providers and microwave users.

C. The Commission's PCS Rules Should Incorporate Incentives for PCS Licensees to Share Spectrum

If the Commission decides to issue PCS licenses for non-overlapping bands, the Commission should recognize those PCS spectrum users who decide to improve their system performance by operating in overlapping bands since such techniques permit more efficient utilization of spectrum. In particular, InterDigital believes that the Commission can best promote greater spectrum utilization by granting modest, but specific rewards, to those who adopt such techniques. By way of example, if the Commission licenses non-overlapping frequency bands and if adjacent licensees agree to overlap and thereby share their spectrum, both licensees should be rewarded with an additional 5 MHz bandwidth bonus in their transmit and receive bands. This plan will provide a strong incentive for PCS spectrum users to adopt efficient spectrum sharing techniques thus furthering the public interest in full utilization and conservation of scarce spectrum resources.

III. The Commission Should Ensure That Potential Competition Between Cellular and PCS Services Does Not Result in Unnecessary Limitations on PCS

Many parties recognize that PCS will compete with existing cellular services. Possibly recognizing this, several cellular providers have urged the Commission to grant PCS licenses authorizing 10 MHz transmit and 10 MHz receive bands. In assessing the debate concerning the amount of spectrum to be allocated to each PCS licensee, the Commission must carefully weigh the following critical consideration: if spectrum is used properly, the broader the bandwidth, the better the quality of service and the greater capacity of the system. In light of these undisputed facts, proposals to issue 20 MHz PCS licenses are, in effect, a call to limit the quality of PCS services. However, there is a broad consensus that the American consumer wants and expects PCS systems to provide the convenience of a wireless system, but with superior wired-line quality. Clearly, PCS systems that are markedly limited in capacity and quality will not meet consumer demand and will fall far short of industry expectations.

Rather than handicap PCS systems by allocating 20 MHz licenses, InterDigital recommends that the Commission consider increasing the spectrum provided to cellular providers to that eventually allocated to the PCS licensee, provided that the new wide-bandwidth cellular system be used for personal communications services. Such an allocation by the FCC will ensure the high quality of service that is demanded by consumers and critical to the success of PCS, while increasing overall competition in wireless services.

IV. All Entities Should be Accommodated Within the Eligibility and Licensing Structure Rules

In the Notice, all of the Commission's proposals for eligibility and licensing requirements, in one way or the other, restrict the number of entities eligible for PCS licensing. In InterDigital's initial comments, it recommended that all qualified entities should be allowed to acquire an interest in a PCS license. To this end, InterDigital proposed a licensing mechanism which permits universal eligibility for all entities. This licensing mechanism envisions three nationwide licensing consortia, modeled on a general/limited partnership arrangement.[13] Under InterDigital's approach, the partnership would initially be capitalized at $150-250 million. All general partners (no limit) would contribute a like amount to join the partnership and be required to sell limited partnerships (franchises). Limited partners would enter the group under a lesser fee, perhaps $1 million each.

The general partners would be permitted to build and operate the top fifteen markets and the limited partners (as franchisees) would have pre-emptive rights to build and operate the rest of the markets. All capital paid into the partnership would be used first to pay for relocation of microwave users in those markets built by the partnership and the franchisees. In view of the limited spectrum available and the existence of several competing services (e.g., cellular and E-SMR), InterDigital's nationwide consortium licensing approach would permit widespread participation in PCS with sufficient initial capitalization.

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[13] See InterDigital Comments at Appendix D.

MCI proposes a licensing plan similar in concept to InterDigital's proposal.[14] The MCI proposal, however, does not envision the accumulation of a large capital base through general and limited partners' contributions to join the consortia. InterDigital believes that a large capital base will be required to address technology standardization and development and the relocation of fixed microwave users throughout the country. Absent such a "war chest," the long transition period for relocation of fixed microwave licensees will almost certainly impede the smooth entry of new PCS competitors into the wireless marketplace.

Also, MCI's proposal does not incorporate a mechanism that allows all markets to be built out simultaneously through "limited partnership/franchisee" arrangements. InterDigital believes that the major objectives of the FCC in this proceeding -- universality, speed of deployment, diversity of services, and competitive delivery -- can only be achieved through an innovative licensing scheme which provides strong incentives for licensees to build out all markets, not only the top markets. The need for such an innovative licensing scheme is clear in light of the "business as usual" approach apparently adopted by some segments of the cellular industry. After nine years of cellular licensing, some rural cellular service system are not yet operating and subscribers still do not have access to cellular services.

The initial comments in this proceeding clearly support InterDigital's view that it will be critical for the Commission to use nationwide licensing as the centerpiece of a

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[14] See MCI Comments, at 4-17.

licensing plan to provide access to PCS for all entities large and small. Many agree that a repeat of the earlier cellular licensing scheme will ensure that PCS will not reach the public, other than in the major markets, until well into the first decade of the next century.

As was the case with cellular licensing, conventional licensing approaches generate an expensive and time-consuming process whereby prospective providers attempt to leapfrog the licensing process to acquire the necessary Commission authority to provide service. Any conventional licensing approach is by definition exclusionary; auctions, lotteries and comparative hearings all result in winners and losers and, like the cellular licensing process, results in an enormous loss of time and capital. As experience with cellular licensing showed, the transaction costs incurred in consolidating cellular properties after initial lotteries will result in a net loss to the U.S. economy. Indeed, the funds needed to cover these transaction costs could almost pay to relocate every fixed microwave link in the country. Although auctions do have the advantage of bringing the transaction costs up front, they draw off significant capital which could be better used directly to relocate microwave users and pay for the technology development needed to bring PCS to the public. Further, siphoning capital from the private sector into government coffers seems unlikely to stimulate the private sector investment needed for a vigorous PCS industry. InterDigital thus opposes granting licenses by auction or other conventional licensing approaches.

V. In Accessing PCS Technologies, the FCC Should Consult The Engineering and Technical Scholar Community as Well as Commercial Industry

The Commission's establishment of a PCS service, including spectrum allocation, is possibly the achievement in the wireless area that will have the greatest impact on subscribers and the wireless industry since the establishment of the cellular band in the 1960s. While the Commission invites comments in this and other PCS-related proceedings from all interested parties, it should recognize that responses come primarily from those with a vested commercial interest in PCS rules. Thus, the Commission often hears from prospective manufacturers and service providers, but rarely from the "third part of the equation," the scholars, university professors, and researchers who fully understand the theoretical and practical constraints of all of the PCS systems proposed. These individuals are the ones who develop the theory and applications, and who author the analyses that those in commercial industry try to understand and use to build efficient systems. These individuals are in a position to contribute critically important technical information and analyses essential to ensuring that the full potential of PCS is realized in the United States. (Nonetheless, these scholars typically get "no credit" from their academic institutions for responding to the Notice and otherwise have little incentive to participate in the FCC regulatory process.)

InterDigital recommends that the Commission request the IEEE Communications Society to establish a panel of university professors who are conducting research in PCS and related fields and that this panel provide a written and oral presentation to the Commission, and others, at a major Communication Society Conference (such as ICC

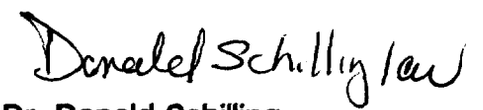
or Globecom). That presentation should respond to specific technical questions put forth by the Commission. Many issues under consideration in this proceeding are highly technical and involve engineering and technology areas that are rapidly changing and subject to differing interpretations. The promise of PCS is too great and the public interest in rapid implementation of high quality PCS systems too compelling to ignore a major source of essential information.

VI. CONCLUSION

The Commission should move quickly to allocate at least 40 MHz (and preferably 60 MHz of spectrum) to multiple PCS licensees under a scheme that will encourage spectrum sharing. Further, the Commission should embrace an all-inclusive licensing mechanism based on three nationwide consortia open to all. The Commission should ensure that the consortia set aside capital paid in initially so that sufficient capital is available to permit widespread bandclearing of fixed licensees. Finally, InterDigital encourages the Commission to seek the views of academicians and researchers in the noncommercial PCS community concerning the myriad technical aspects of the competing PCS proposals under consideration in this proceeding.

These recommendations will ensure the rapid and efficient delivery of competitive PCS to the U.S. public.

Respectfully submitted,



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